

Spectrum Issues and WRC-07 Preparation

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By: Mike Biggs, ATO-W , Sr. Engineer

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**Federal Aviation
Administration**



Aeronautical Communications

- **Two categories**
 - Those provided for safety and regularity of flight
 - Allocations designated as “(route)” or “(R)”
 - Air Traffic Control (ATC) and Aeronautical Operational Control (AOC)
 - Others
 - Aeronautical Administrative Communications (AAC), Aeronautical Passenger Communications (APC), etc
- **Almost all FAA-provided services occur in “(R)” spectrum.**
 - AM(R)S for terrestrial (a/g, a/a) communications
 - AMS(R)S for satellite communications
- **Remainder of this presentation deals with AM(R)S**



Existing AM(R)S Bands

Frequency Band	Comments
2.85-3.025 MHz	High Frequency (HF) Communications
3.4-3.5 MHz	HF Communications
4.65-4.7 MHz	HF Communications
5.45-5.48 MHz (Region 2)	HF Communications
5.48-5.68 MHz	HF Communications
6.525-6.685 MHz	HF Communications
8.815-8.965 MHz	HF Communications
10.005-10.1 MHz	HF Communications
11.275-11.4 MHz	HF Communications
13.26-13.36 MHz	HF Communications
17.9-17.97 MHz	HF Communications
21.924-22 MHz	HF Communications
108-117.975 MHz	Added at WRC-03, for ICAO standard navigation and surveillance systems)
117.975-137 MHz	VHF Air-ground communications

AM(R)S Spectrum Issues

- **AM(R)S spectrum is at or near saturation in high traffic areas.**
 - **AM(R)S spectrum is required to support future navigation and surveillance systems**
 - Those future systems are designed to provide maximum situational awareness to the pilot, and may not meet the "property of waves" definition required to operate in ARNS spectrum
 - There are no “surveillance” services/allocations
 - Future navigation/surveillance systems may incorporate additional data functions to foster voluntary user equipage (e.g., providing FIS-B as part of new ADS-B system)
- AM(R)S spectrum is required to support planned introduction of unmanned aircraft systems into air traffic services airspace



WRC-07 Agenda Item 1.6

- ***To consider additional allocations for the aeronautical mobile (R) service in parts of the bands between 108 MHz and 6 GHz, in accordance with Resolution 414 (WRC-03) ...***
 - *Initial focus should be on bands currently available to aviation*
 - *If requirements cannot be met in those bands, then look elsewhere*



Other Existing Aviation Bands

Existing ARNS Bands below 6 GHz*

74.8-75.2 MHz	Marker Beacons
108-117.975 MHz	VOR, ILS Localizer, GBAS
328.6-335.4 MHz	ILS Glide Slope
960-1215 MHz	DME, TACAN, SSR
1300-1350 MHz	Footnote 5.337 limits to ground-based radars and associated airborne transponders
1559-1610 MHz	Shared with GNSS
1610-1626.5 MHz	Shared with AMS(R)S and MSS
2700-2900 MHz	Footnote 5.337 limits to ground-based radars and associated airborne transponders
4200-4400 MHz	Footnote 5.438 limits to use by radio altimeters installed on aircraft and associated ground transponders
5000-5150 MHz	Priority to MLS (5.444), portions shared with FSS, RNSS and/or AMS(R)S
5150-5250 MHz	MLS shared with Fixed Satellite (E-s)

*Small bands exist below 1 MHz. Due to limited bandwidth available, these are not considered candidates for future AM(R)S systems

Why ARNS bands for AM(R)S?

- **Regulatory considerations**
 - Safety services require a higher degree of protection of the spectrum in use
 - International scope of aviation requires global allocations
 - Internationally attention has been limited to existing aviation bands
- **Technical considerations**
 - Systems operating in the safety services are internationally standardized, offering relatively consistent characteristics
- **Experience**
 - Recent development of Universal Access Transceiver (UAT)



Status of studies

- Reviewed use and characteristics of all civil aviation bands
- **Current focus internationally (ICAO, ITU-R WP 8B):**
 - Possible extension of current AM(R)S band into parts of VHF aeronautical radionavigation band (i.e., portion of 108-117.975 MHz) to provide short-term relief
 - Portion of 960-1215 MHz band (portions of “L-Band”) for line-of-sight system are currently under study (e.g., the 960-1024 MHz band has been recommended as a suitable band)
 - Low-moderate data throughput
 - Portions of 5000-5150 MHz band (“C-Band”) for airport surface network system are currently under study (e.g., the 5091-5150 MHz band has been recommended as a suitable band)
 - Short range, high data throughput



Why portions of VHF Band for AM(R)S?

- **Primarily European initiative**
 - Expansion of current DSB-AM system
 - Possibly just a software change to existing avionics
 - Conflicting reports
- **Band limited due to concerns from FM broadcast community**
 - Introducing airborne transmitters
- **Limited capability ... “Stop-gap” measure**



Why portions of L-Band for AM(R)S?

- **Good propagation characteristics**
 - Line-of-sight transmission with moderate transmit power
- **Internationally standardized current use offers opportunities**
 - 960-977 MHz used globally for national allotments
 - DME/TACAN in 978-1024 MHz limited to ground transmitters
- **Need a large amount of available spectrum**
 - Requirement for a number of distinct channels
 - Provides options for designed compatibility with incumbent users
 - Frequency hopping/diversity
 - Time/bandwidth trade-offs
 - Design-in future growth (need positive cost/benefit to foster equipage)
- **User equipment/technology readily available**

Why portions of C-Band for AM(R)S?

- **Good short-range characteristics**
 - Poor propagation maximizes frequency re-use
 - Ideal for airport surface network
- **Internationally lightly used**
 - Planned for MLS
 - Satellite feeder links in 5091-5150 MHz
- **Large amount of available spectrum**
- **User equipment/technology readily available**
 - IEEE LAN standards may be extensible
 - New 802.16e offers required mobility



Conclusions

- **Evolving applications in civil aviation necessitate additional spectrum for safety communications**
 - Portions of the spectrum already allocated to the Aeronautical Radionavigation Service (ARNS) offer a partial solution to those AM(R)S needs
- **Civil aviation has an interest in maintaining viable and fully-utilized spectrum**
 - ITU actively pursuing new allocations for 3-G wireless in other aviation bands (e.g., 2700-2900 MHz radar band)
- **Civil aviation safety-of-flight requirements make sharing with commercial services difficult**
 - Need to optimize use of current aviation bands

